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PICKERING NGS "A" UNIT 3
PICK-UP INSPECTION OF
CONCRETE CONTAINMENT BOUNDARY

Report No. 90-261-K

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ABSTRACT

The concrete containment boundary of the Pickering NGS "A" Unit 3 reactor building was inspected. The inspection, which consisted of visual observations and nondestructive testing, found the concrete to be in good condition, with the exception of localized cracks, areas of spalled concrete and a few exposed reinforcing bars.

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PICKERING NGS "A" UNIT 3
PICK-UP INSPECTION OF
CONCRETE CONTAINMENT BOUNDARY

1.0 INTRODUCTION

An inspection of the accessible concrete containment boundary of the Pickering NGS "A" Unit 3 reactor building was carried out in August and October 1990. The inspection, which followed the work plan prepared by the Central Production Services Department, consisted of visual observation and nondestructive testing. The work was carried out from the interior and exterior of the reactor building. This report summarizes the results of the inspection.

2.0 INSPECTION RESULTS

The visual observations are summarized in Table 1, and the nondestructive test results are given in Table 2. The inspection locations are listed below.

(a) Dome and closure plug (Figures 1 to 6)

(b) Perimeter wall (Figures 7 to 11)

(c) Break-out panel

(d) Base slab

(e) Interface between the Pressure Relief Duct (PRD) link and the reactor building

(f) Concrete around major penetrations such as air locks and main steam pipes (Figures 12 and 13)

(g) Calandria vault

(h) Hatches and covers in the reactor building

(i) Concrete structures inside the reactor building (Figure 14).

3.0 SUMMARY

The inspection conducted from the interior of the reactor building identified randomly oriented cracks at the spring line (Figure 1). These cracks were generally less than 0.25 mm in width. On the exterior of the building, a crack was observed in the top of the dome (Figure 5) and a few reinforcing bars were exposed in the south portion of the building (Figure 4). A few localized cracks were also present in the interior and exterior of the perimeter wall. At one location, a crack exhibiting efflorescence was observed on the exterior of the perimeter wall (Figure 9). Around two of the air locks, localized areas of concrete had spalled (Figures 12 and 13). In the interior of the reactor building, the dry-pack or grout at some of the column bases had debonded (Figure 14).

The nondestructive testing of localized areas on the exterior of the reactor building indicated that the concrete was of good quality.

4.0 CONCLUSIONS

The concrete in the Unit 3 containment boundary was found to be in good condition, with the exception of localized cracks, spalled concrete and a few exposed reinforcing bars. The cracks observed were generally less than 0.25 mm wide. A few areas of spalled concrete were present around the air locks. The exposed reinforcing bars were observed in the perimeter wall near the dome on the south portion of the reactor building.

The localized cracks, spalled concrete and exposed reinforcing bars do not appear to be significant at present; however, these areas should be monitored during the next inspection.

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Table 1

Pickering NGS "A" Unit 3
Pick-up Inspection of Concrete Containment Boundary

Inspection Location	Observations
(a) Dome and closure plug - Interior	- The dome was visually inspected at the spring line, El 371', from the interior of the reactor building. Numerous randomly oriented cracks with widths generally less than 0.25 mm were observed in the concrete (Figure 1). Most of these cracks had been covered with paint. - The concrete around the dome closure plug was inspected from a distance from the walkways in the reactor building at El 376' (Figure 2). No major cracks or deterioration of the concrete was observed.
- Exterior	- The exterior of the dome was visually inspected from the roof of the powerhouse, from the top of the PRD and from the top of the reactor building. The inspection conducted from the roof of the powerhouse did not identify any major cracks or deterioration of the concrete in the dome (Figure 3). - The inspection conducted from the top of the PRD identified a few minor cracks in the concrete near construction joints. Exposed horizontal reinforcing steel was observed in the south portion of the building (Figure 4). - Cracks in the dome were observed during the pressure test conducted in 1989 and reported in Research Division Report S89-42-k. The presence of these cracks was investigated during this inspection, but because of the weathered surface of the concrete and the small crack width, the cracks could not be located. One crack was identified in the east quadrant of the dome (Figure 5). This crack was filled with deposits that made it difficult to determine the crack width. - The concrete around the embedded steel for the dome plug appeared to have been repaired in the past (Figure 6).
(b) Perimeter wall - Interior	- The perimeter wall was visually inspected at accessible locations from the interior of the reactor building. Most of the cracks observed in the concrete were randomly orientated with widths <0.25 mm (Figure 7). These cracks were generally covered with paint. - Vertical cracks, up to 0.75 mm wide at the surface of the concrete, were observed in the top portion of the perimeter wall at the spring line (Figure 8).
- Exterior	- The exterior of the reactor building was visually inspected at accessible locations. Blistering and cracking of the paint at some locations made the identification of cracks difficult; however, randomly oriented cracks with widths <0.25 mm were observed in the concrete. - At El 317', a crack exhibiting effloresence was present in the northeast quadrant (Figure 9) and a localized area of debonded concrete was observed in the northwest quadrant (Figure 10 and 11). - At El 310', effloresence and some minor cracking was noted along vertical construction joints in the east quadrant.

Table 1 (Cont'd)

Pickering NGS "A" Unit 3
Pick-up Inspection of Concrete Containment Boundary

Inspection Location	Observations
(c) Breakout Panel - Interior	- No cracking or deterioration of the concrete was observed in the breakout panel inspected from the interior of the reactor building.
- Exterior	- On the exterior of the breakout panel, special attention was given to the areas that exhibited leakage during the pressure test conducted in 1989. The lower portion of the breakout panel on the exterior of the reactor building is covered with metal cladding which restricted access to the concrete in this area. The portion of the panel above the cladding did not exhibit any cracks or deterioration of the concrete.
(d) Base Slab - Interior	- The base slab was inspected where accessible from the interior of the reactor building. No significant cracks or deterioration of the concrete was observed.
- Exterior	- In the accessible locations inspected, no cracking or deterioration of the concrete was noted.
(e) Interface between the PRD link and the reactor building	
- Interior	- The concrete was visually inspected from ladders and platforms. Cracks with widths <0.25 mm were observed in a few locations.
- Exterior	- The exterior of the link was visually inspected from the top of the PRD and from ladders and platforms to the south of the building. Other than a debonded repair at the top of the link, no cracking or deterioration of the concrete was observed.
(f) Concrete around major penetrations such as air locks and main steam pipes. - Interior	- The concrete around several of the major penetration including all of the air locks was inspected from the interior of the reactor building. Spalling of the concrete in the floor at Air Lock 6 was observed (Figure 12). Cracks with widths <0.25 mm were observed in the concrete extending from some of the embedded parts.
- Exterior	- On the exterior of the reactor building, a small area of spalled concrete was present adjacent to Air Lock 4 (Figure 13). - Cracks with widths <0.25 mm were also observed in the concrete extending from the air locks and some of the embedded parts inspected.
(g) Calandria Vault	- The interior of the calandria vault was not inspected. - The accessible concrete on the exterior of the vault was given a cursory inspection. No cracks or deterioration of the concrete was observed.

Table 1 (Cont'd)

Pickering NGS "A" Unit 3
Pick-up Inspection of Concrete Containment Boundary

Inspection Location	Observations
(h) Hatches and covers in the reactor building	- The interior or underside of the hatches and covers was not inspected. - The exterior or top of the hatches and covers at El 317.5' near the centre of the building were given a cursory inspection. No major cracks or deterioration of the concrete was observed.
(i) Concrete structures inside the reactor building	- The dry-pack or grout at the base of steel columns at El 317' was found to be debonded at some locations (Figure 14). - Cracks with widths <0.25 mm were noted in the concrete at various locations in the reactor building. - In the north portion of the building at El 254', a vertical crack was observed in a wall at Col Line A.

Table 2

Pickering NGS "A" Unit 3
Pick-up Inspection of Concrete Containment Boundary
Nondestructive Test Results

Inspection Location	Impact Hammer Results	
	Average* Rebound Number	Relative** Strength (MPa)
Exterior surface of the perimeter wall north of Air Lock 1 at Elevation 254'	48.9	50
Exterior surface of the perimeter wall north of Air Lock 4 at Elevation 274'	42.7	38
Exterior surface of the perimeter wall on the north portion of the building at Elevation 317'.	39.1	33
Exterior surface of the reactor building on the southwest portion of the dome.	44.0	41
Exterior surface of the reactor building on the northeast portion of the dome.	41.5	37

* The rebound number reported is the average of ten readings.

** The impact hammer does not give an absolute value for the strength of the concrete. It actually gives a relative strength value, based on the surface concrete, which can be used for comparison purposes.

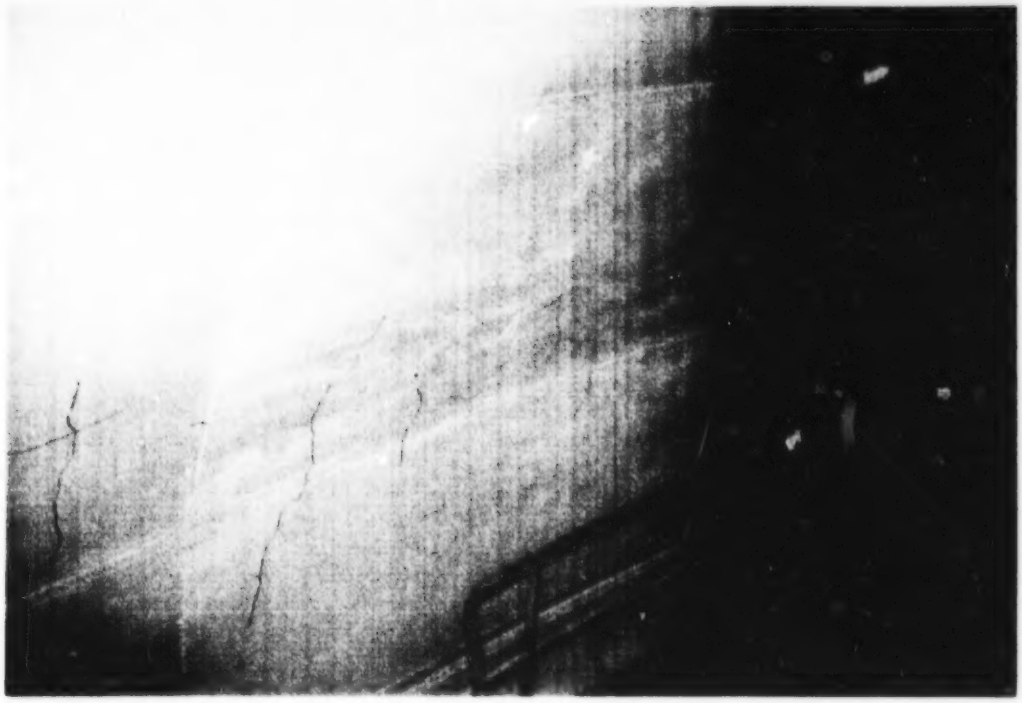

Figure 1 Randomly oriented cracks present on the interior surface of the reactor building dome above the spring line.

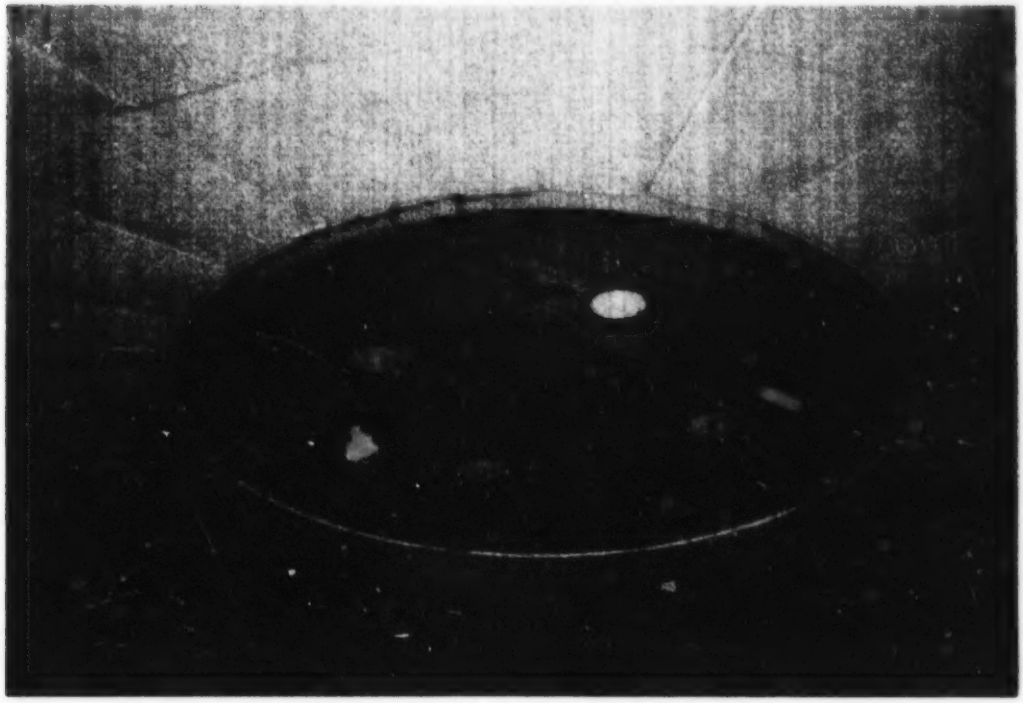

Figure 2 The dome plug as viewed from the interior of the reactor building.

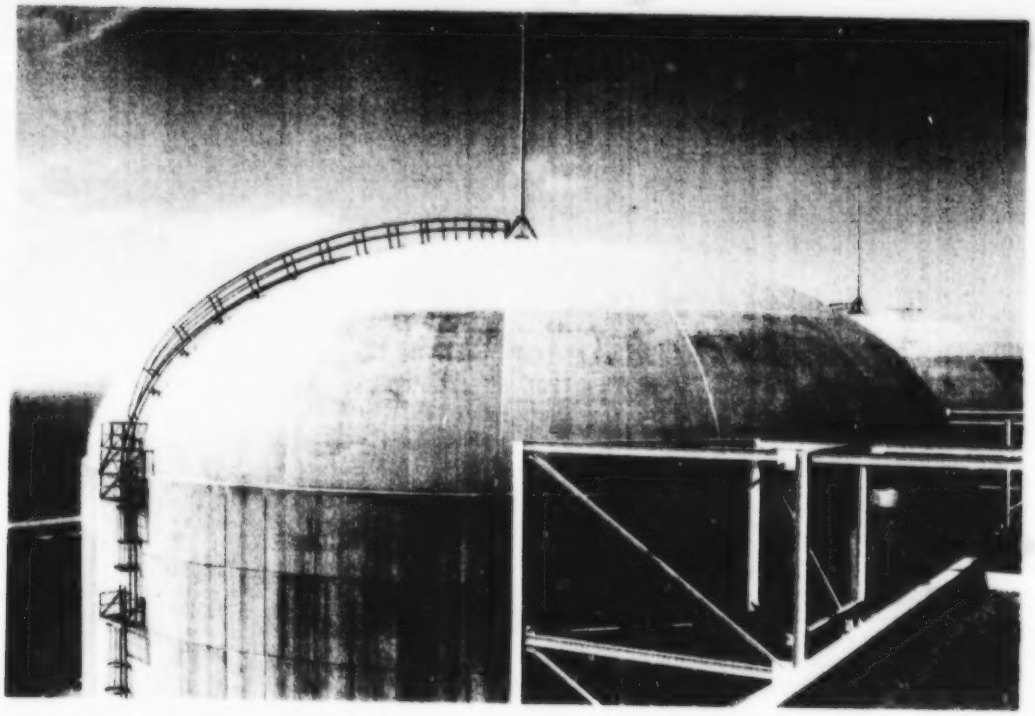

Figure 3 The northeast quadrant of the Unit 3 reactor building as viewed from the powerhouse roof.

Figure 4 South portion of the Unit 3 reactor building as viewed from the top of the PRD. Note the exposed horizontal reinforcing steel.

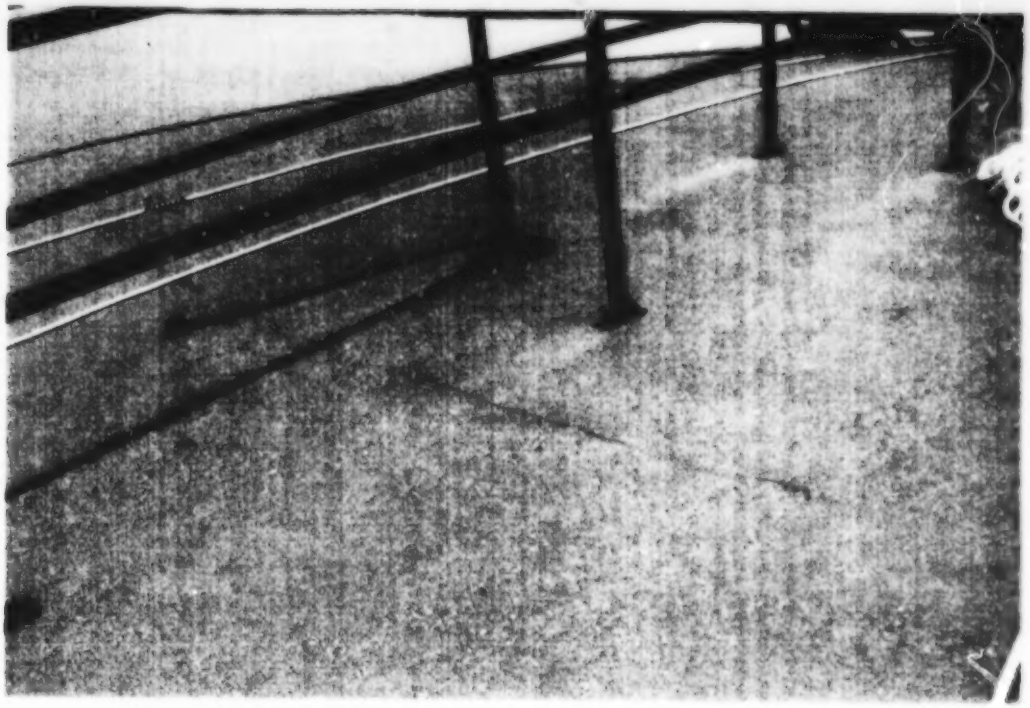

Figure 5 A crack in the east quadrant of the reactor building dome. Because of deposits in the crack, its width was difficult to determine.

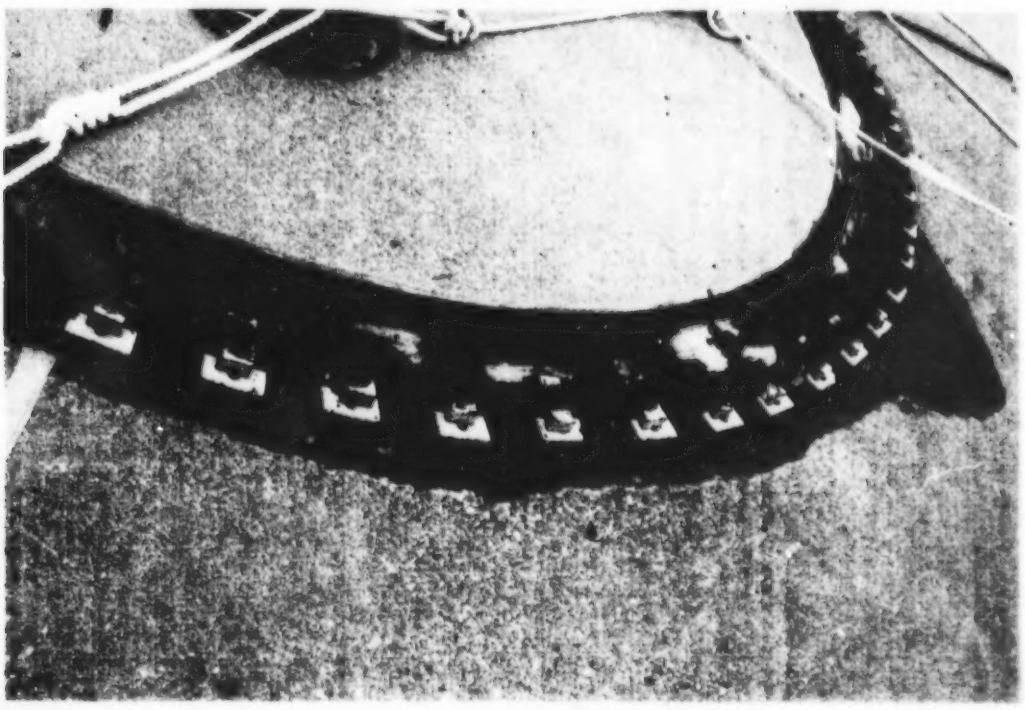

Figure 6 The repairs made previously to the concrete around the dome plug.

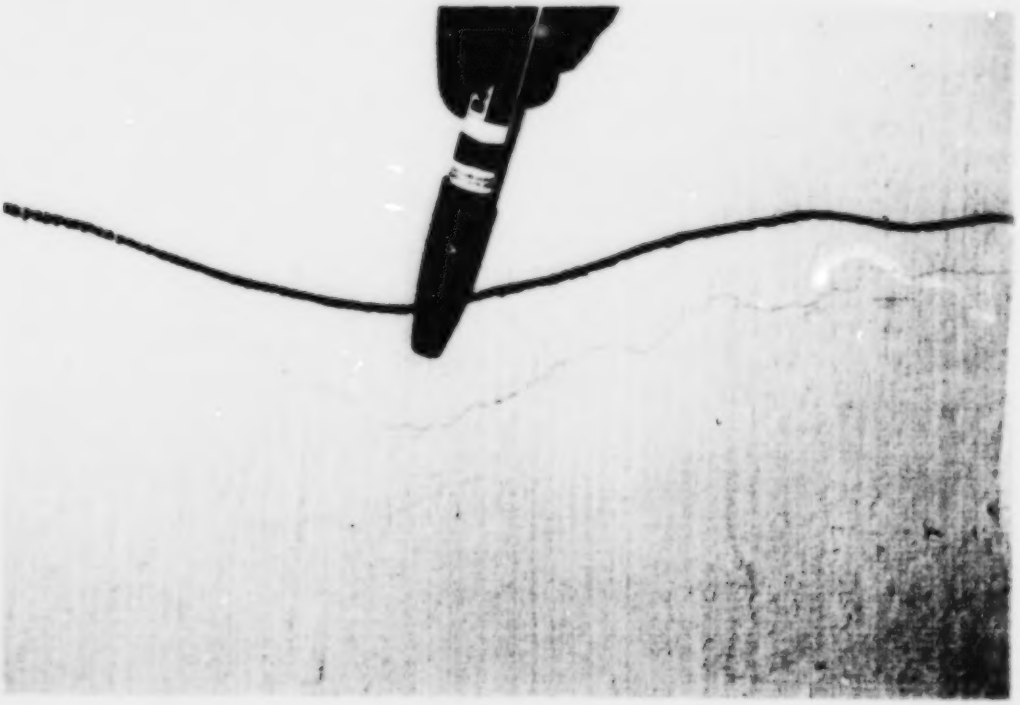

Figure 7 Typical crack with a width <0.25 mm observed in the concrete of the dome and perimeter wall during the inspection conducted of the interior of the reactor building.

Figure 8 Typical crack with a width of 0.75 mm observed in the interior of the reactor building in the top portion of the perimeter wall at the spring line.

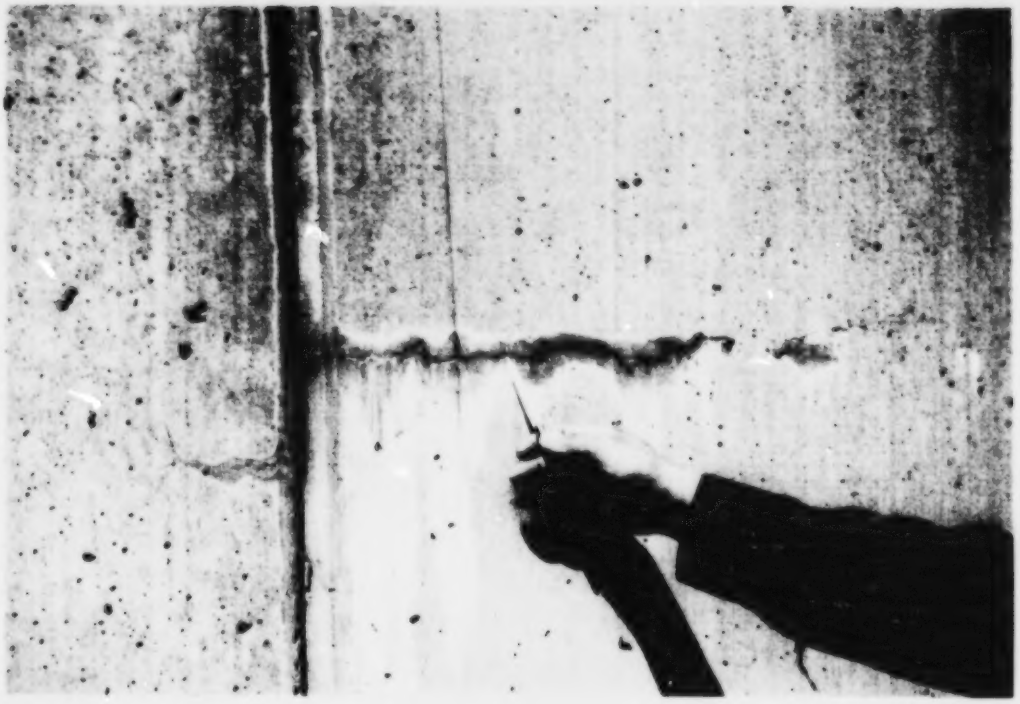

Figure 9 A crack with efflorescence observed in the exterior of the reactor building at El 317' in the northeast quadrant.

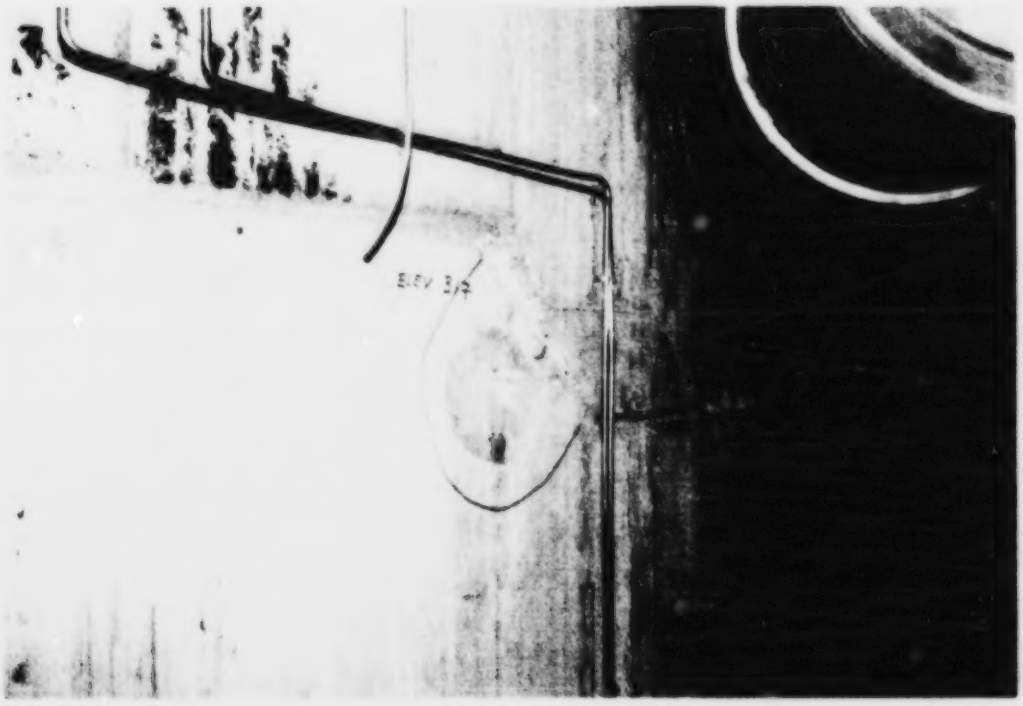

Figure 10 An area of debonded concrete in the exterior of the reactor building at El 317' in the northwest quadrant.

Figure 11 Cracks exhibiting efflorescence on the exterior of the reactor building in the perimeter wall at El 317' in the northeast quadrant.

Figure 12 Spalled concrete on the interior of the reactor building at Air Lock 6.

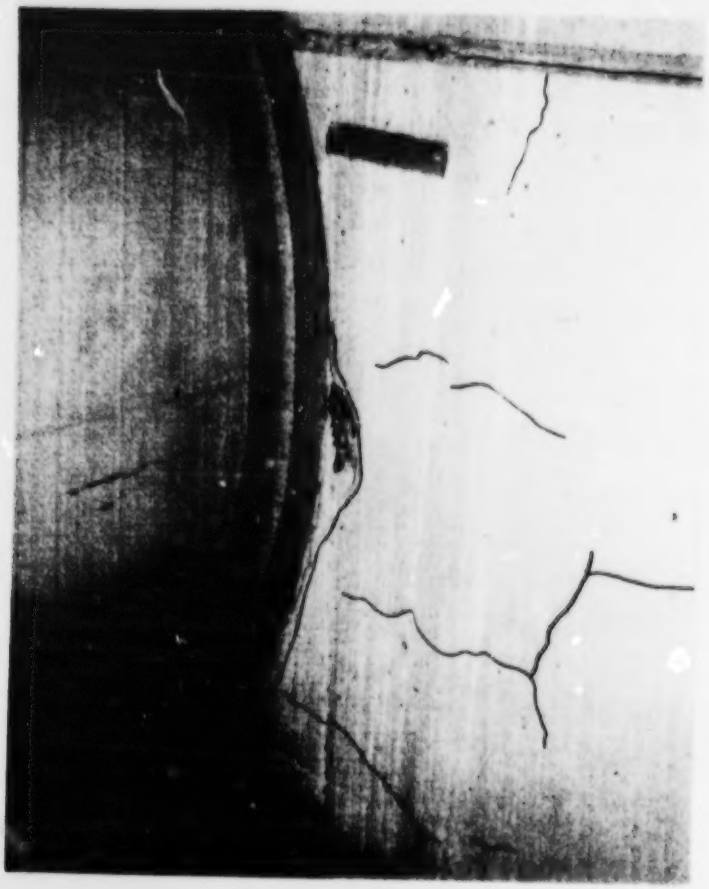

Figure 13 Spalled concrete and cracks on the exterior of the reactor building at Air Lock 4.

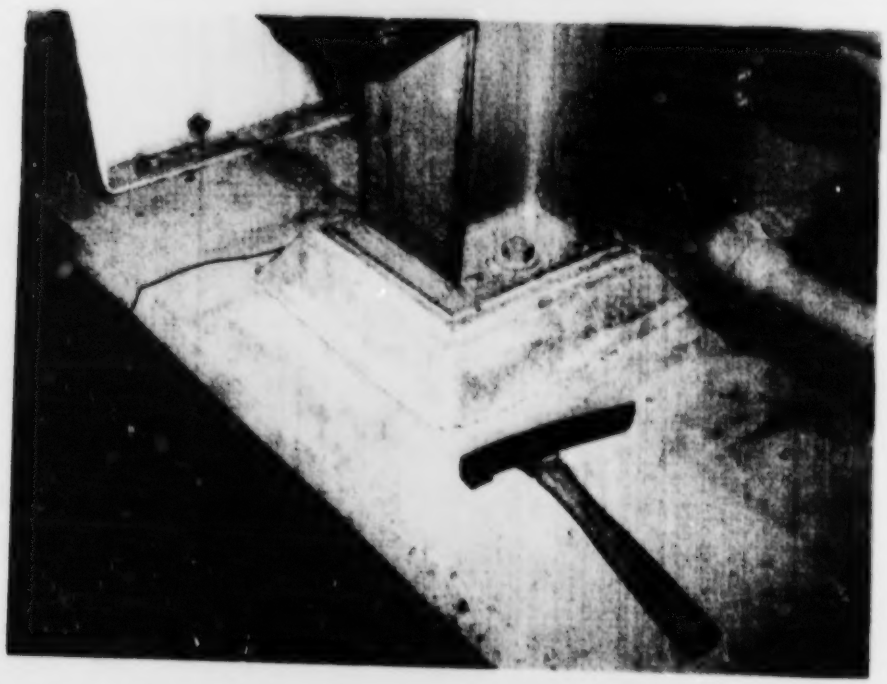

Figure 14 Debonded dry-pack at a column base on the interior of the reactor building at El 317'.